

Bacteria



Would you believe that a single gram of soil—which is about the mass of a pencil eraser—may have more than 2.5 billion bacteria? A handful of soil may contain trillions of them!

The group Bacteria consists of single-celled organisms that do not have a nucleus. Bacteria live in soil, water, and other organisms. Some Bacteria have relatives that date back about 3.5 billion years!

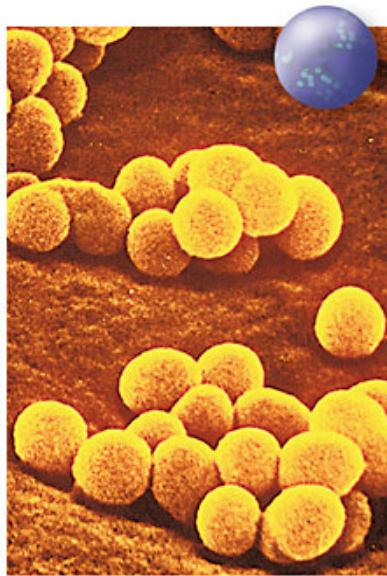
Some Characteristics of Bacteria

There are more bacteria on Earth than there are all other living things combined. Most bacteria are too small to be seen without a microscope. But not all bacteria are the same size.

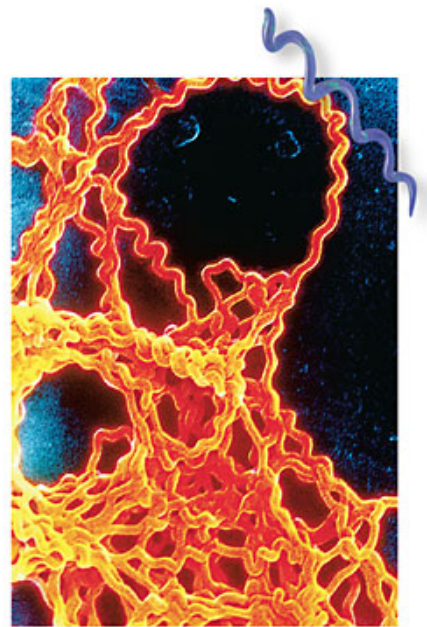
Members of the domain Bacteria are usually one of three main shapes: rod shaped, spherical, and spiral shaped. Most bacteria have a rigid cell wall that gives them this shape. Bacilli are rod shaped. Cocci are spherical. Spirilla are long and spiral shaped. Each shape helps bacteria in a different way.



Bacilli (buh SIL iE) are rod shaped. They have a large surface area, which helps them take in nutrients. But a large surface area can cause them to dry out easily.



Cocci (KAHK SIE) are spherical. They do not dry out as quickly as rod-shaped bacteria.



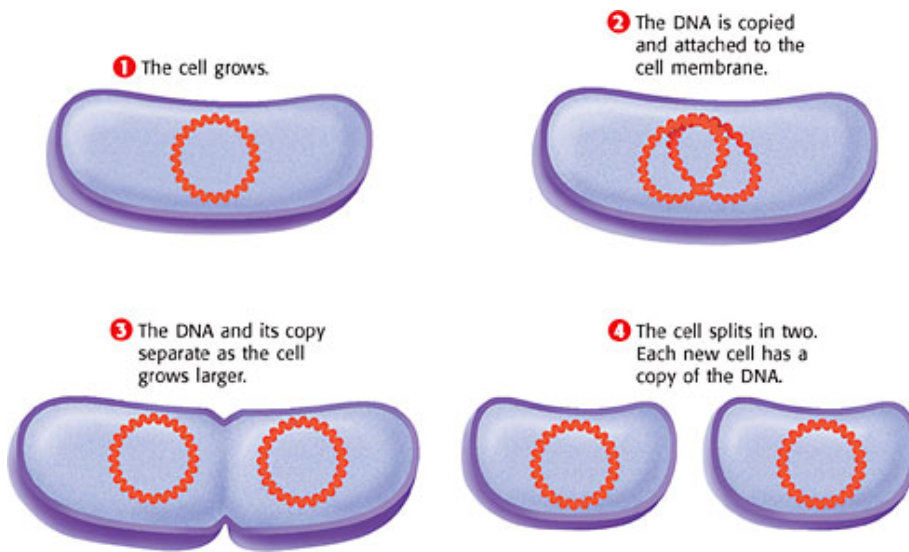
Spirilla (spie RIL uh) are long and spiral shaped. They use flagella at both ends to move like a corkscrew.

No Nucleus!

All bacteria are single-celled organisms that do not have a nucleus, known as a **prokaryote**. Prokaryotes are organisms by themselves, but some bacteria stick together to form strands or films. Most prokaryotes are much simpler and smaller than organisms you are familiar with. Prokaryotes also reproduce differently than other organisms.

Prokaryote Reproduction

Bacteria reproduce by the process below, called binary fission. **Binary fission** is reproduction in which one single-celled organism splits into two single-celled organisms.



Classification of Bacteria

Bacteria are classified in part by the way they get food. Most bacteria, such as those that break down leaves, are consumers. Consumers get their food by eating other organisms. Many bacteria are decomposers, which feed on dead organisms. Other bacterial consumers live in or on the body of another organism. Bacteria that make their own food are called *producers*. These bacteria use energy from sunlight to make food and are often green.

Humans couldn't live without bacteria, but bacteria can also cause harm. Scientists learned in the 1800s that some bacteria are pathogenic. **Pathogenic bacteria** are bacteria that cause disease. Pathogenic bacteria get inside a host organism and take nutrients from the host's cells. In the process, they harm the host. Today, we are protected from many bacterial diseases by vaccination. Many bacterial diseases can also be treated with antibiotics.

Diseases in Other Organisms

Bacteria cause diseases in other organisms as well as in people. Have you ever seen a plant with odd-colored spots? If so, you've seen bacterial damage to plants. Pathogenic bacteria attack plants, animals, protists, fungi, and even other bacteria. They can cause damage to grain, fruit, and vegetable crops. Plants are sometimes treated with antibiotics. Scientists have also genetically engineered certain plants to be resistant to disease-causing bacteria.

Viruses



A **virus** is a microscopic particle that gets inside a cell and often destroys the cell. Many viruses cause diseases, such as the common cold, flu, and acquired immune deficiency syndrome (AIDS).

It's a Small World

Viruses are tiny. They are smaller than the smallest bacteria. About 5 billion virus particles could fit in a single drop of blood.

Are Viruses Living?

Like living things, viruses contain protein and genetic material. But viruses don't act like living things. They can't eat, grow, break down food, or use oxygen. Viruses are not cells. They do not have cytoplasm or organelles. In fact, a virus cannot function on its own. A virus can reproduce only inside a living cell that serves as a host. A **host** is a living thing that a virus or parasite lives on or in. Using a host's cell as a tiny factory, the virus forces the host to make viruses rather than healthy new cells.

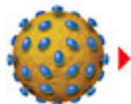
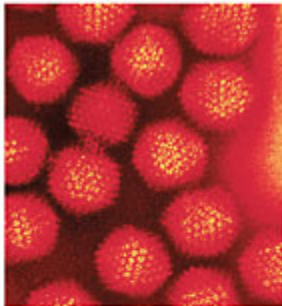
Classifying Viruses

The four main shapes of viruses are shown in the pictures below. Every virus is made up of genetic material inside a protein coat. The protein coat protects the genetic material and helps a virus enter a host cell.



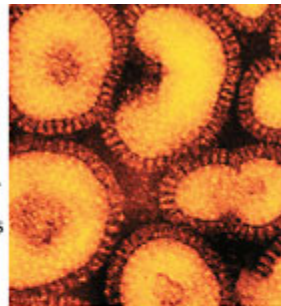
Crystals

The polio virus is shaped like the crystals shown here.



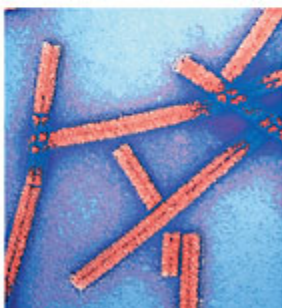
Spheres

Influenza viruses look like spheres. HIV is another virus that has this structure.



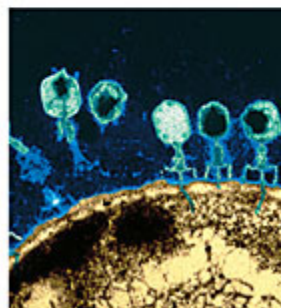
Cylinders

The tobacco mosaic virus is shaped like a cylinder and attacks tobacco plants.



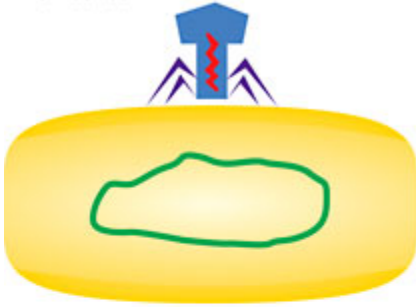
Spacecraft

One group of viruses attacks only bacteria. Many of these look almost like spacecraft.

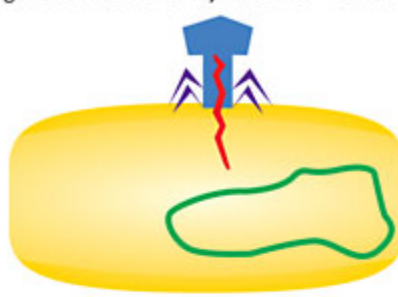


The one thing that viruses do that living things also do is make more of themselves. Viruses attack living cells and turn them into virus factories. This cycle is called the *lytic cycle*.

1 The virus finds and joins itself to a host cell.



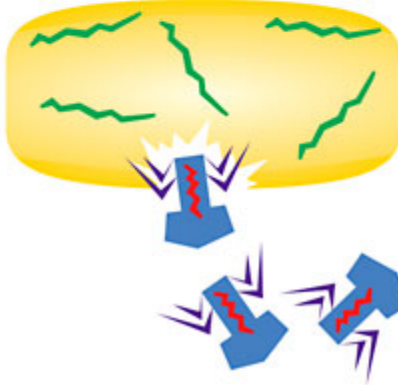
2 The virus enters the cell, or the virus's genetic material is injected into the cell.



3 Once the virus's genes are inside, they take over the direction of the host cell and turn it into a virus factory.



4 The new viruses break out of the host cell, which kills the host cell. The cycle begins again.



Treating a Virus

Antibiotics do not kill viruses. But scientists have recently developed antiviral medications. Many of these medicines stop viruses from reproducing. Because many viral diseases do not have cures, it is best to prevent a viral infection from happening in the first place. Childhood vaccinations give your immune system a head start in fighting off viruses. Having current vaccinations can prevent you from getting a viral infection. It is also a good practice to wash your hands often and never to touch wild animals. If you do get sick from a virus, it is often best to rest and drink extra fluids.

Parasites



Parasites are living things that use other living things - like your body - for food and a place to live. You can get them from contaminated food or water, a bug bite, or sexual contact. They may be transmitted from animals to humans, from humans to humans, or from humans to animals.

Parasites range in size from tiny, one-celled organisms, called protozoa to worms that can be seen with the naked eye – up to two meters long! The illnesses they can cause range from mild discomfort to debilitating illness and possibly death.

Prevention is especially important. There are no vaccines to prevent parasitic diseases, but some medicines are available to treat parasitic infections once a person gets the disease.

In humans, there are three main disease causing parasite categories: protozoa, helminthes, and ectoparasites.

Protozoa are single-celled free-living or parasitic organism, with an ability to multiply in humans. This capacity not only contributes to their survival, but it takes only one to cause a very serious infection.

Intestinal living protozoa are typically transmitted via consumption of fecal matter (poop!), by way of contaminated food, water or personal contact. Those living in your environment are commonly transmitted by way of a bite from a fly, mosquito, sand fly, etc.

Helminths, or worms, are multi cellular free-living or parasitic organisms, which are generally large enough to be seen. In their adult form, they cannot multiply in humans. The three main human parasite worm groups include:

flatworms ~ flukes & tapeworms

thorny-headed worms ~ adult forms reside in your gastrointestinal tract

roundworms ~ adult forms can reside in your gastrointestinal tract, blood, lymphatic system or tissues below the skin

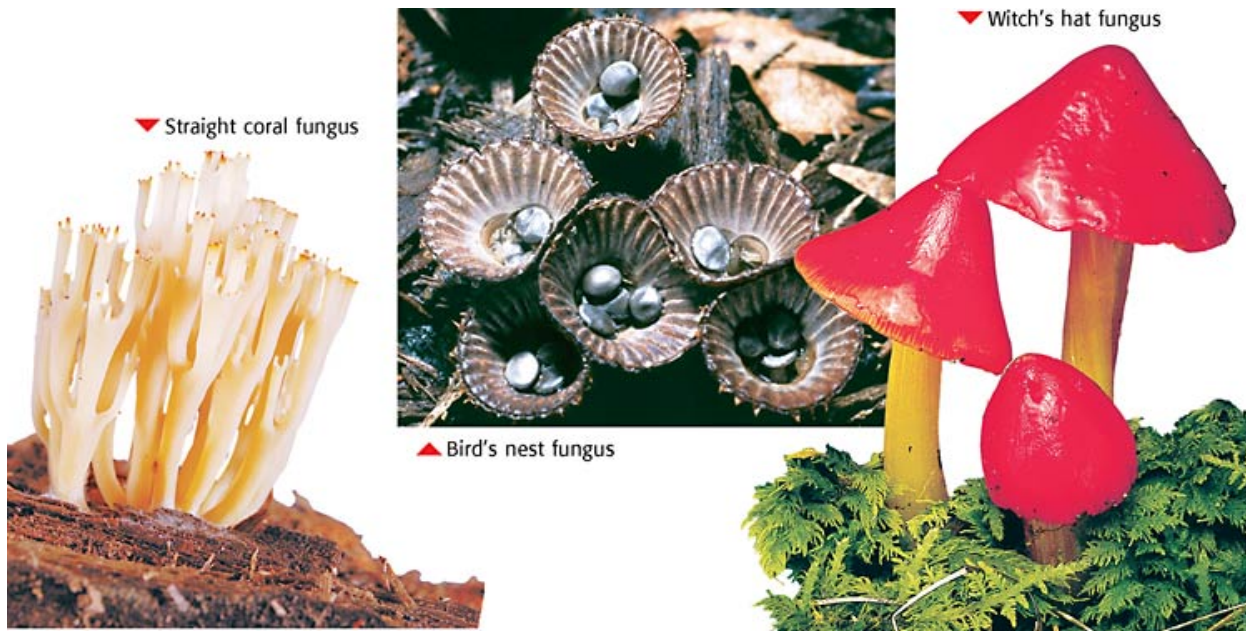
Ectoparasites burrow into your skin and can remain there for relatively long periods of time, in some cases months. These infectious disease causing parasites include lice, fleas, ticks, and mites.

Blood-sucking arthropods, such as mosquitoes, may broadly be included. Arthropods can cause diseases on their own, but more importantly, they are carriers transmitting numerous disease causing pathogens. These carried pathogens cause the highest proportion of infectious diseases, in some cases resulting in death with diseases like malaria, yellow fever, dengue fever, and West Nile virus. Parasitic infections cause a tremendous disease burden. On a global scale, malaria causes the most deaths, killing about a million people every year.

Fungi

Characteristics of Fungi

Fungi have rigid cell walls and no chlorophyll (green pigment). They are so different from other organisms that they are placed in their own kingdom. As you can see in the pictures below, fungi come in a variety of shapes, sizes, and colors.



Food for Fungi

Fungi cannot catch or surround food. Fungi must live on or near their food supply. Most fungi are consumers, so they do not make their own food. These fungi get nutrients by secreting digestive juices onto a food source and then absorbing the dissolved food. Many fungi are decomposers, which feed on dead plant or animal matter. Other fungi are parasites.

All fungi are made of eukaryotic cells, which have nuclei. Some fungi are single celled, but most fungi are made of many cells. These many-celled fungi are made up of chains of cells called hyphae (HIE fee).

Making More Fungi

Reproduction in fungi may be either asexual or sexual. Asexual reproduction in fungi occurs in two ways. In one type of asexual reproduction, the hyphae break apart, and each new piece becomes a new fungus. Asexual reproduction can also take place by the production of spores.

Kinds of Fungi

Fungi are classified based on their shape and the way that they reproduce. There are four main groups of fungi. Most species of fungi fit into one of these groups. These groups are threadlike fungi, sac fungi, club fungi, and imperfect fungi.

Threadlike Fungi

A **mold** is a shapeless, fuzzy fungus. This particular mold belongs to a group of fungi called *threadlike fungi*.

Sac Fungi



Sac fungi are the largest group of fungi. Sac fungi include yeasts, powdery mildews, truffles, and morels. But not all sac fungi are helpful. In fact, many sac fungi are parasites. Some cause plant diseases, such as chestnut blight and Dutch elm disease.

Club Fungi

The umbrella-shaped mushrooms are the most familiar fungi. Mushrooms belong to a group of fungi called *club fungi*.

The most familiar mushrooms are known as *gill fungi*. Some varieties are grown to be sold in supermarkets. However, not all gill fungi are edible. For example, the white destroying angel is a very poisonous fungus. Simply a taste of this mushroom can kill someone.



Imperfect Fungi

The *imperfect fungi* group includes all of the species of fungi that do not quite fit in the other groups. Most are parasites that cause diseases in plants and animals. One common human disease caused by these fungi is athlete's foot, a skin disease. Another fungus from this group produces a poison called *aflatoxin*, which can cause cancer.

Some imperfect fungi are useful. *Penicillium* is the source of the antibiotic penicillin. Other imperfect fungi are also used to produce medicines. Some imperfect fungi are used to produce cheeses, soy sauce, and the citric acid used in cola drinks.